## REMARKS

Claims 1, 7-8, 13, 18, 23-28, 30-37, 78-90, and 102-108 are pending in this Application, of which, claims 1, 7-8, 13, 18, 23-28, 30-36, 78-83, 85, 88-90, 102, 104-107, and 108 are currently being amended. Claims 9, 14, 15-16, 18 and 22 are being withdrawn. Claims 20-21 are being cancelled.

The Specification paragraph on page 24, lines 10-18, is being amended to recite "[t]he process monitoring system can include an interferometry analyzer **65** to analyze the electrical output signal from the radiation detector **62**." The interferometry analyzer **65** is shown in the drawing of Figure 9, hence, no new matter is added.

The amendments to the Claims are fully supported by the Claims and Specification as originally filed, and add no new matter, thus, entry of the claim amendments is respectfully requested.

For example, the recitation of radiation source outside the process chamber is supported by at least page 23, line 6 of the Specification. Also, the addition of the word "interferometric" to modify 'signal' is supported by at least page 11, line 9, and page 13, line 3. The addition of the words "plasma emission" to modify 'signal' is supported by at least page 21, line 9. Also, the recitation of an interferometric detector and a plasma emission detector is supported by at least page 20, line 26 through page 22, line 9.

The language "originating from the radiation source" is supported by at least the paragraph starting on page 24, line 20 of the Specification. The addition of "over time" is supported at least at page 11, line 26, and page 18, line 33, and also in Figures 8a and 8b, which show the two signals over time.

The addition of "trace" is supported by at least page 29, line 20. The addition of "values of a sequence of slopes over time" or similar language, is supported by at least the paragraph starting on page 29, line 19; and page 19, line 20. The

addition of "substantially similar to th values of [a s quence of preprogrammed slopes]" is supported by at least page 29, line 2.

**Withdrawal of Claims 9, 14, 15-16, 18 and 22**

The Examiner indicated that claims 9, 14; 15 16, 18 and 22 are intended to be withdrawn from consideration as being directed to a non-elected invention. The Applicant confirms the withdrawal of claims 9, 14, 15-16, 18 and 22 from consideration as being directed to a non elected invention.

**Rejection of Claims 20-21 and 107-108 under 35 USC 112, Second Paragraph**

The Examiner objected to claims 20-21 as being of improper dependent form for being dependent from cancelled claim 19. Claims 20-21 are being cancelled.

The Examiner objected to claims 107-108 as indefinite on grounds that the "slope criteria" has "no clear or necessary relationship to the other claim limitations". The Examiner states the "what variables determine the slope is indeterminable." Claim 107 is being amended to recite "determining whether the values of a sequence of slopes over time of the signal trace are substantially similar to the values of a sequence of preprogrammed slopes." The Applicant believes this makes clear that the slope is taken of one variable, the signal trace, over another variable, time. The Examiner also states that "the criteria one is applying ... is further undefined." The Applicant believes that the amended claim makes clear that the criteria that is being applied is that one sequence of values is being compared to another sequence of values to determine whether they are substantially similar.

Claim 108 is similarly being amended to recite "by determining whether a sequence of values of the slope over time of an amplitude of the detected radiation are substantially similar to the values of a sequence of preprogrammed slopes." The Applicant believes that this claim language should make clear that a sequence of values of a slope of one variable, radiation amplitude, over another variable, time, is

being compared a sequence of preprogrammed values to determine if they are substantially similar.

**Rejection of Claims 23-28 and 30 under 35 USC 102(b) as being anticipated by Busta et al.**

Claims 23-28 and 30 were rejected under 35 USC 102(b) as being anticipated by Busta et al. This rejection is respectfully traversed.

Claim 23 has been amended to recite an apparatus comprising "a radiation source outside the chamber; a plasma emission radiation detector to detect a radiation emission originating from the plasma and generate a plasma emission signal over time, and an interferometric radiation detector to detect a radiation originating from the radiation source and reflected from the substrate and generate an interferometric signal over time; and a controller to receive and evaluate the plasma emission and interferometric signals to determine a process endpoint."

Claim 23 is not anticipated by Busta et al. because Busta et al. does not disclose a plasma emission radiation detector to detect a radiation emission originating from the plasma and generate a plasma emission signal over time, and an interferometric radiation detector to detect a radiation originating from the radiation source and reflected from the substrate and generate an interferometric signal over time. Busta et al only has a detector to detect one radiation and generate only one signal of radiation reflected from the substrate. Also, Busta et al. does not teach a controller to receive and evaluate a plasma emission signal and an interferometric signal to determine a process endpoint. Thus Claim 23 and its dependent claims, are not anticipated by Busta et al.

**Rejection of Claims 23-28 and 30-37 under 35 USC 102(b) as being anticipated by, or in the alternative, under 35 USC 103(a) as obvious over Brooks et al.**

Claims 23-28 and 30-37 were rejected under 35 USC 102(b) as being anticipated, or in the alternative, under 35 USC 103(a) as obvious over Brooks et al. This rejection is respectfully traversed.

Claims 23 and 36

Claims 23 and 36 are not anticipated by Brooks et al because Brooks et al. does not disclose a plasma emission radiation detector in combination with an interferometric radiation detector. Instead, Brooks et al. has a detector to generate two signals both of which are from radiation reflected off the substrate. Also, Brooks et al. does not teach a controller, as in claim 23, or a computer, as in claim 36, to receive and evaluate the two different interferometric and emission signals to determine a process endpoint. Instead, Brooks et al. describes a microprocessor board to evaluate two similar signals both of which were generated by radiation reflected from the substrate. Thus, Claims 23 and 36, and those depending therefrom, are not anticipated by Brooks et al.

Claims 23 and 36 are furthermore not obvious over Brooks et al. because Brooks et al. does not suggest the motivation for deriving an apparatus having two different detectors, a plasma emission detector and an interferometric detector, nor the motivation for developing a controller or a computer that evaluates an interferometric signal and an emission signal from each detector to determine endpoint. Instead, Brooks et al. only describes detecting radiation reflected from the substrate and does not suggest using radiation emitted from the plasma. Brooks et al. also does not suggest or provide motivation to use a controller or a computer that determines an endpoint from two signals containing different kinds of information. It would not be obvious to use such a controller or computer because the two signals that it is receiving contain fundamentally different types of information. There is no suggestion or motivation to use a controller or computer to combine the two different types of signals. Thus, Claims 23 and 36, and those depending therefrom, ar patentable over Brooks

et al.

Claim 31

Claim 31 is not anticipated by Brooks et al. because brooks et al. does not teach "(c) detecting a radiation emission originating from the plasma and generating a plasma emission signal over time; (d) detecting a radiation reflected from the substrate and generating a interferometric signal over time; and (e) evaluating the plasma emission and interferometric signals to determine the occurrence of an event in the process zone or a property of a material on the substrate." Instead, Brooks et al. detects two signals both of which are reflected off the substrate. Thus, Brooks et al. does not teach evaluating both an interferometric signal and a plasma emission signal, i.e. two different kinds of signals. Instead, Brooks et al. only evaluates two similar types of signals generated by radiation reflected from the substrate. Thus, Claim 23 and the claims depending therefrom, are not anticipated by Brooks et al.

Claim 31 is furthermore not obvious over Brooks et al. because Brooks et al. also does not suggest or provide motivation to detect both radiation emitted from the plasma as well as radiation reflected from the substrate. Brooks et al. also does not suggest or provide motivation to determine an endpoint by evaluating together these two different kinds of signals. It would not be obvious to do so because the two different signals contain fundamentally different types of information. Thus, Claim 31, and those depending therefrom, are patentable over Brooks et al.

**Rejection of Claims 23-28 and 30-35 under 35 USC 102(b) as being anticipated by Schoenborn**

Claims 23-28 and 30-35 were rejected under 35 USC 102(b) as anticipated by Schoenborn. This rejection is respectfully traversed.

Claim 23

Claim 23 is not anticipated by Schoenborn because Schoenborn does not

disclose a plasma emission radiation detector to detect a radiation emission originating from the plasma and generate a plasma emission signal over time, and an interferometric radiation detector to detect a radiation originating from the radiation source and reflected from the substrate and generate an interferometric signal over time. Instead, Schoenborn has a detector to generate one signal over time from detected radiation generated by plasma emission. Also, Schoenborn does not teach a controller to receive and evaluate the different interferometric and emission signals to determine a process endpoint. Instead, Schoenborn has an apparatus to evaluate only the one type of signal that is being generated. Thus, Claim 23, and those claims depending therefrom, are not anticipated by Schoenborn.

Claim 31

Claim 31 is not anticipated by Schoenborn because Schoenborn does not teach "(c) detecting a radiation emission originating from the plasma and generating a plasma emission signal over time; (d) detecting a radiation reflected from the substrate and generating a interferometric signal over time; and (e) evaluating the plasma emission and interferometric signals to determine the occurrence of an event in the process zone or a property of a material on the substrate." Instead, Schoenborn generates one signal over time from detected plasma emission radiation. Also, Schoenborn does not teach evaluating the two different interferometric and emission signals together to determine a process endpoint. Instead, Schoenborn evaluates only the one type of signal that is being generated. Thus, Claim 31, and those claims depending therefrom, are not anticipated by Schoenborn.

**Rejection of Claims 36-37 under 35 USC 103(a) as being unpatentable over Schoenborn**

Claims 36-37 have been rejected under 35 USC 103(a) as being unpatentable over Schoenborn. This rejection is respectfully traversed.

Claim 36 is not obvious over Schoenborn because Schoenborn do s not teach a plasma emission radiation detector to detect a radiation emission originating

from th plasma and gen rat a plasma emission signal over time, and an int rferometric radiation detector to detect radiation originating from the radiation source and reflected from the substrate and generate an interferometric signal over time. Instead, Schoenborn has a detector to generate one signal over time from detected radiation generated by plasma emission. Schoenborn provides no suggestion or motivation to have an interferometric radiation detector to generate a signal from radiation that is reflected of the substrate and that originates from a radiation source outside the chamber. Also, Schoenborn does not teach a computer to receive and evaluate the two different interferometric and emission signals to determine a process endpoint. Instead, Schoenborn has an apparatus to evaluate only one type of signal that is being generated. There is no motivation or suggestion provided by Shoenborn to have an apparatus to evaluate two different types of signals, an interferometric signal and a plasma emission signal.

**Rejection of Claims 1, 8, 13, 23-24, 27-28, 31, 34, 37, 78-79, 82-84, 87, and 107-108 under 35 USC 102(b) as anticipated by, or in the alternative, under 35 USC 103(a) as obvious over Angell et al.**

The Examiner rejected claims 1, 8, 13, 23-24, 27-28, 31, 34, 37, 78-79, 82-84, 87, and 107-108 under 35 USC 102(b) as anticipated by, or in the alternative, under 35 USC 103(a) as obvious over Angell et al. This rejection is respectfully traversed.

Claims 1, 13, and 78

Claims 1, 13, and 78 are not anticipated by Angell et al. because Angell et al. does not teach a radiation source outside a process chamber that is capable of providing non-polarized radiation. Instead, Angell et al. teaches a plasma emission source inside the chamber. Nor does Angell et al. teach an interferometric radiation detector to detect the reflected radiation and generate an interferometric signal as recited in the claims. Instead, Angell et al. teaches a plasma emission detector. Thus, as amended, Claims 1, 13 and 78, and the claims dependent therefrom, are not

anticipated by Angell et al.

Amended Claims 1, 13, and 78 are not obvious over Angell et al. The Examiner states that "while radiation or wavelengths reflected off the substrate are not discussed, the light detected from the plasma would have been expected to include both unreflected light emitted by the plasma; plus that which was emitted then reflected from the substrate."

Claims 1, 13, and 78 recites a radiation source outside the process chamber that provides non-polarized radiation that is reflected from the substrate in the chamber, and an interferometric radiation detector that detects the reflected radiation and generates an interferometric signal. In contrast, Angell et al. teach a plasma emission source inside the chamber and a plasma emission detector to detect the plasma emission. Even if radiation reflected from the substrate includes both radiation emitted by the plasma and reflected from the substrate as well as reflected radiation from the outside source, the different apparatus components of the present claim distinguish the claimed apparatus form Angell et al. There is no motivation from the teachings of Angell et al. to substitute the inside plasma emission with an outside radiation source, nor to substitute the plasma emission detector with an interferometric radiation detector.

Furthermore, Angell et al. does not provide any suggestion or motivation to teach a controller to evaluate the dynamic variance of the interferometric signal generated by an interferometeric radiation detector. As explained in the Specification, interferometric analysis was conventionally performed by counting the number of periodic maxima or minima arising from the constructive and destructive interference of the reflected radiation over time. There is no suggestion or motivation in Angell et al. to deviate from this practice to derive a controller to receive an interferometric signal and calculate a dynamic variance within a predefined time period of the interferometric signal by subtracting an intensity value at a minimum point from an intensity value at a maximum point. Instead the system taught by Angell et al. is based on plasma emission, and moreover, Angell et al. does not have a controller that subtracts an

intensity value at a minimum point from an intensity value at a maximum point. Angell et al., instead, simply identifies an "intensity drop off within a certain period of time in order to qualify as being an acceptable end-point peak." Thus, Claims 1, 13, and 78, and the claims dependent therefrom, are patentable over Angell et al.

Claims 8 and 83

Claims 8 and 83 are not anticipated by Angell et al. because Angell et al. does not teach a method comprising the steps of directing non-polarized radiation onto the substrate from a radiation source outside the process zone; detecting the non-polarized radiation reflected from the substrate and generating an interferometric signal; and calculating a dynamic variance within a predefined time period of the interferometric signal.

Instead, Angell et al. detects radiation emitted from a plasma emission to generate a plasma emission signal. The step of generating an interferometric signal is not the same step as the step of generating an emission signal, even if the radiation reflected from the substrate has a component originating from the plasma emission, as suggested by the Examiner. Thus, claims 8 and 83 are not anticipated by Angell et al.

Furthermore, Claims 8 and 83 are not obvious over Angell et al. because Angell et al. provides no suggestion or motivation to evaluate the dynamic variance of an interferometric signal generated by detecting radiation originating from an external source and reflected from the substrate. Interferometric signals are analyzed in prior art by counting the number of maxima or minima over a time period. There is no suggestion or motivation by Angell et al. to deviate from this practice to calculate a dynamic variance within a predefined time period by subtracting an intensity value at a minimum point from an intensity value at a maximum point, as defined by the claims. Thus, Claims 8 and 83, and the claims dependent therefrom are non-obvious over Angell et al.

Claim 23

Claim 23 is not anticipated by Angell et al. because Angell et al. does not teach "a radiation source outsid the chamber; a plasma emission radiation detector to detect a radiation emission originating from the plasma and generate a plasma emission signal over time, and an interferometric radiation detector to detect a radiation originating from the radiation source and reflected from the substrate and generate an interferometric signal over time; and a controller to receive and evaluate the plasma emission and interferometric signals to determine a process endpoint" as recited in the claim. Angell et al. instead teaches a plasma emission source inside the chamber. Angell et al. also does not teach an interferometric radiation detector to detect the reflected radiation and generate an interferometric signal. Thus, as amended, Claim 23, and the claims dependent therefrom, are not anticipated by Angell et al.

Amended Claim 23 is not obvious over Angell et al. Claim 23 recites a radiation source outside the process chamber that provides radiation that is reflected from the substrate in the chamber, and an interferometric radiation detector that detects the reflected radiation and generates an interferometric signal, and a plasma emission radiation detector that detects plasma radiation emission and generates a plasma emission signal. In contrast, Angell et al. teaches a plasma emission source inside the chamber and a plasma emission detector to detect the plasma emission. There is no motivation from the teachings of Angell et al. to add an outside radiation source, nor to add an interferometric radiation detector.

Nor does Angell et al. provide any suggestion or motivation to teach a controller to receive and evaluate the plasma emission and interferometric signals to determine an endpoint, or to combine such a signal with a signal generated from emission radiation. The apparatus of Angell et al. performs a mathematical analysis of multiple wavelengths of detected emission radiation. There is no suggestion or motivation to combine this apparatus with an interferometric radiation detector that generates an interferometric signal. Thus, the controller to receive both signals and determine an endpoint is non-obvious over Angell et al. Therefore, Claim 23, and those claims dependent therefrom, are patentable over Ang ll et al.

Claim 31

Claim 31 is not anticipated by Angell et al. because Angell et al. does not teach "(c) detecting a radiation emission originating from the plasma and generating a plasma emission signal over time; (d) detecting a radiation reflected from the substrate and generating an interferometric signal over time" as recited in the claim. Instead, Angell et al. detects a plasma emission at multiple wavelengths. Angell et al. also does not teach evaluating the different plasma emission and interferometric signals together to determine an endpoint. Instead, Angell et al. evaluates only a plasma emission signal. Thus, as amended, claim 31, and those claims depending therefrom, are not anticipated by Angell et al.

Furthermore, Claim 31 is not obvious over Angell et al. because Angell et al. does not provide motivation to detect two different types of radiation and generate different interferometric and plasma emission signals. Angell et al. also does not suggest or provide motivation to evaluate the different interferometric and plasma emission signals together to determine an endpoint. Therefore, Claim 31, and those dependent therefrom, are patentable over Angell et al.

Claim 107

Claim 107 is not anticipated by Angell et al. because Angell et al. does not teach "a radiation detector to detect the reflected radiation and generate a signal trace; and a controller to receive the signal trace and determine a property of the overlying or underlying material of the substrate in the chamber by determining whether the values of a sequence of slopes over time of the signal trace are substantially similar to the values of a sequence of preprogrammed slopes" as recited in the claim. Instead, Angell et al. teaches a detector to detect radiation emitted from the plasma and an apparatus to determine an end-point from a single change in intensity of a selected wavelength. Thus, Claim 107 is not anticipated by Angell et al.

Claim 107 is also not obvious over Angell et al. There is no motivation in Angell et al. to have a detector to generate a signal from detected reflected radiation. Furthermore, the apparatus of Angell et al. determines the occurrenc of a single event,

i.e. an endpoint, by evaluating a signal generated from plasma mission radiation. There is also no suggestion or motivation in Angell et al. to have a controller to determine "whether the values of a sequence of slopes over time of the signal trace are substantially similar to the values of a sequence of preprogrammed slopes" as recited in the claim. Thus, Claim 107 is patentable over Angell et al.

Claim 108

Claim 108 is not anticipated by Angell et al. because Angell et al. does not teach "(b) detecting radiation reflected from the substrate before, during, or after processing of the substrate; and (c) evaluating the detected radiation to determine a property of the overlying or underlying material of the substrate in the process zone by determining whether a sequence of values of the slope over time of an amplitude of the detected radiation are substantially similar to the values of a sequence of preprogrammed slopes" as recited in the claim. Instead, Angell et al. detects radiation emitted from the plasma and determines end-point from a single change in intensity of a selected wavelength. Thus, claim 108 is not anticipated by Angell et al.

Claim 108 is also not obvious over Angell et al. There is no motivation taught by Angell et al. to generate a signal from detected reflected radiation. Instead, Angell et al. generates a signal from detected plasma emissions. Furthermore, Angell et al. determines the occurrence of a single event, i.e. an endpoint, by evaluating a signal generated from plasma emission radiation. There is also no teaching in Angell et al. to determine "whether the values of a sequence of slopes over time of the signal trace are substantially similar to the values of a sequence of preprogrammed slopes" as recited in the claim. Thus, Claim 108 is patentable over Angell et al.

**Rejection of Claims 7, 25-26, 30, 32-33, 80-81, 85-86, 88-90 and 102-106 under 35 USC 103(a) as unpatentable over Angell et al.**

The Examiner rejected claims 7, 25-26, 30, 32-33, 80-81, 85-86, 88-90 and 102-106 under 35 USC 103(a) as unpatentable over Angell et al. This rejection is resp ctfully traversed.

Claims 88 and 102

Claims 88 and 102 are not obvious over Angell et al. because Angell et al. does not teach a radiation source outside the chamber, the radiation source capable of providing radiation that is at least partially reflected from the substrate during processing and a radiation detector to detect the reflected radiation and generate an interferometric signal. Instead, Angell et al. teaches a detector to detect radiation emitted from the plasma and does not provide motivation to use a radiation source outside the chamber and a detector to generate an interferometric signal.

Angell et al. also does not teach a computer, as in Claim 88, or a controller, as in claim 102, which can (i) receive the interferometric signal, (ii) calculate a dynamic variance within a predefined time period of the interferometric signal by subtracting an intensity value at a minimum point from an intensity value at a maximum point. Instead, Angell et al. teaches an apparatus to determine an endpoint by evaluating a change in intensity of a signal generating by detecting plasma emission. Angell et al. provides no suggestion or motivation to evaluate the dynamic variance of an interferometric signal. Nor does Angell et al. teach subtracting an intensity value at a minimum point from an intensity value at a maximum point. Thus, Claim 88 and 102, and those claims dependent therefrom, are patentable over Angell et al.

**R jection of Claims 1, 8, 13, 23-24, 27-28, 31, 34-37, 78-79, 82-84, 87, and 107-108 under 35 USC 102(b) as anticipated by, or in th alternative, under 35 USC 103(a) as obvious over Buck et al.**

The Examiner rejected claims 1, 8, 13, 23-24, 27-28, 31, 34, 37, 78-79, 82-84, 87, and 107-108 under 35 USC 102(b) as anticipated by, or in the alternative, under 35 USC 103(a) as obvious over Buck et al. This rejection is respectfully traversed.

Claims 1, 13 and 78

Claims 1, 13 and 78 are not anticipated by Buck et al. because Buck et al. does not teach a radiation source outside the process chamber, the radiation source capable of providing non-polarized radiation that is at least partially reflected from the substrate in the chamber, an interferometric radiation detector to detect the reflected radiation and generate an interferometric signal. Instead, Buck et al. teaches a detector to monitor low frequency emissions from the plasma, and in some embodiments combines this with a detector to monitor voltages on electrical connectors in the RF power supply and gas energizer system. Buck et al. also does not teach a controller, as in claims 1 and 78, or a computer, as in claim 13, to calculate a dynamic variance within a predefined time period of the interferometric signal by subtracting an intensity value at a minimum point from an intensity value at a maximum point. Instead, Buck et al. teaches an apparatus that uses "a simple comparison with a threshold value" (column 3, lines 39-40). Comparing the value of a signal at a single time to a threshold constant is different than calculating the difference in signal values over a predefined time period and using this quantity to determine a property or endpoint. Thus, Claims 1, 13 and 78 are not anticipated by Buck et al.

The Examiner also states that "the photodetector [of Buck et al.] is noted to be pointed at the plasma near the wafer surface, hence directed at any reflected wavelengths/frequenci s." However, it should be noted that Buck et al. has a filter to filter out all but low frequency components, for example, filtering out frequencies higher

than 230 Hz. Frequencies 230 Hz and below may not contain any useful reflection information about layers with thickness on the order of microns. For example, in air, the wavelength corresponding to electromagnetic radiation at 230 Hz would be roughly 1 million meters. Such radiation may not be useful to generate an interferometric signal from a thin layer because the wavelength is orders of magnitude greater than the thickness of the layers being examined. Therefore, the detector and filter of Buck et al. may not inherently generate interferometric information.

Moreover, Claims 1, 13, and 78 are also not obvious over Buck et al. because Buck et al. provides no suggestion or motivation to have a radiation source outside the chamber and a detector to detect radiation reflected off the substrate from the radiation source and generate an interferometric signal. Buck et al. also provides no suggestion or motivation to have a controller or computer to evaluate the dynamic variance of an interferometric signal generated by detecting radiation originating from an external source and reflected from the substrate. Interferometric signals are analyzed in prior art by counting the number of maxima or minima over a time period. There is no suggestion or motivation by Buck et al. to deviate from this practice to detect a dynamic variance as defined by the claim. Thus, Claims 1, 13, and 78, and those claims dependent therefrom, are patentable over Buck et al.

Claims 8 and 83

Claims 8 and 83 are not anticipated by Buck et al. because Buck et al. does not teach detecting radiation reflected from the substrate that originates from a radiation source outside the process zone, and generating an interferometric signal. Instead, Buck et al. detects plasma emission radiation to generate a plasma emission signal, and filters out all but low frequencies. Furthermore, Buck et al. does not teach determining a property by calculating a dynamic variance within a predefined time period of the interferometric signal by subtracting an intensity value at a minimum point from an intensity value at a maximum point. Instead, Buck et al. teaches using a simple threshold comparison to determine endpoint. Thus, Claims 8 and 83, and those claims dependent therefrom, are not anticipated by Buck et al.

Claims 8 and 83 are also not obvious over Buck et al. Buck et al. provides no suggestion or motivation to detect radiation reflected off the substrate from a radiation source outside the process zone. Buck et al. also does not suggest or provide motivation to determine a property by evaluating the dynamic variance of an interferometric signal generated by detecting radiation originating from an external source and reflected from the substrate. Interferometric signals are analyzed in prior art by counting the number of maxima or minima over a time period. There is no suggestion or motivation by Buck et al. to deviate from this practice to evaluate a dynamic variance as defined by the claim. Thus, Claims 8 and 83, and those claims dependent therefrom, are patentable over Buck et al.

Claims 23 and 36

Claims 23 and 36 are not anticipated by Buck et al. because Buck et al. does not teach "a plasma emission detector to detect a radiation emission originating from the plasma and generate a plasma emission signal over time, and an interferometric radiation detector to detect a radiation originating from the radiation source and reflected from the substrate and generate an interferometric signal over time ..." as recited in the claims. Instead, Buck et al. only teaches a detector to detect plasma emissions and generate a plasma emission signal, and a filter to filter out all but low frequencies in the signal. Buck et al. also does not teach a controller, as in claim 23, or a computer, as in claim 36, to receive and evaluate the plasma emission and interferometric signals to determine a process endpoint. Instead, Buck et al. teaches a controller to evaluate only a plasma emission signal. Thus, Claims 23 and 36, and those claims dependent therefrom, are not anticipated by Buck et al.

Claims 23 and 36 are also not obvious over Buck et al. Buck et al. provides no suggestion or motivation to have an interferometric detector to generate an interferometric reflection signal. Buck et al. further does not suggest or provide motivation to have a controller or computer to receive and evaluate the interferometric and plasma emission signals together to determine a process endpoint. Therefore,

Claims 23 and 36, and those claims dependent therefrom, are patentable over Buck et al..

Claim 31

Claim 31 is not anticipated by Buck et al. because Buck et al. does not teach "(c) detecting a radiation emission originating from the plasma and generating a plasma emission signal over time; (d) detecting a radiation reflected from the substrate and generating an interferometric signal over time" as recited in the claim. Instead, Buck et al. monitors low frequency emissions from the plasma to generate a signal and in some embodiments also generates a signal from monitoring voltages of RF components. Thus, Claim 31 and the claims dependent therefrom, are not anticipated by Buck et al..

Claim 31 is also not obvious over Buck et al. because Buck et al. provides no suggestion or motivation to generate one plasma emission signal and one interferometric reflection signal. Buck et al. monitors a plasma emission signal and filters this signal. Buck et al. further does not teach "evaluating the plasma emission and interferometric signals to determine the occurrence of an event in the process zone or a property of a material on the substrate" as recited in the claim. Buck et al. provides no suggestion or motivation to evaluate a signal generated from reflection radiation and a signal generated from emission radiation. Therefore, Claim 31, and those claims dependent therefrom, are patentable over Buck et al.

Claim 107

Claim 107 is not anticipated by Buck et al. because Buck et al. does not teach "a radiation detector to detect the reflected radiation and generate a signal trace; and a controller to receive the signal trace and determine a property of the overlying or underlying material of the substrate in the chamber by determining whether the values of a sequence of slopes over time of the signal trace are substantially similar to the values of a sequence of preprogrammed slopes" as recited in the claim. Instead, Buck et al. teaches a detector to monitor emissions from the plasma, a filter to filter out high frequencies, and an apparatus to use a thr shold comparison to determine transitions.

Thus, claim 107 is not anticipated by Buck et al.

Claim 107 is also not obvious over Buck et al. There is no motivation in Buck et al. to have an interferometric detector to generate an interferometric signal from detected reflected radiation. Furthermore, there is also no motivation in Buck et al. to have a controller to determine whether a sequence of slopes of the generated signal matches a sequence of preprogrammed slopes. Buck et al. has an apparatus that uses a simple threshold comparison, which is a mathematically different criteria that evaluating a slope as defined in the claim. Buck et al. does not teach, suggest, or provide motivation to have a controller that evaluates a change in signal over time rather than simply evaluating if the signal reaches a certain absolute value. Thus, Claim 107 is patentable over Buck et al.

Claim 108

Claim 108 is not anticipated by Buck et al. because Buck et al. does not teach "(b) detecting radiation reflected from the substrate before, during, or after processing of the substrate; and (c) evaluating the detected radiation to determine a property of the overlying or underlying material of the substrate in the process zone by determining whether a sequence of values of the slope over time of an amplitude of the detected radiation are substantially similar to the values of a sequence of preprogrammed slopes ..." as recited in the claim. Instead, Buck et al. detects emissions from the plasma, filters out high frequencies, uses a simple threshold comparison to determine a single transition or a series of transitions. Thus, claim 108 is not anticipated by Buck et al.

Claim 108 is also not obvious over Buck et al. There is no motivation in Buck et al. to generate a signal from detected reflected radiation. Instead, Buck et al. generates a signal from detected plasma emissions. Furthermore, there is also no motivation in Buck et al. to determine whether a sequence of slopes of the generated signal matches a sequence of preprogrammed slopes. Buck et al. uses a simple threshold comparison, which is a mathematically different criteria that evaluating a slope. Buck et al. does not teach, suggest, or provide motivation that it is the change in

signal over time that is the important criteria, rath r than simply reaching a certain absolute value. Thus, Claim 108 is patentable over Buck et al.

**Rejection of Claims 7, 25-27, 30, 32-33, 80-81, 85-86, 88-90 and 102-106 under 35 USC 103(a) as unpatentable over Buck et al.**

The Examiner rejected claims 7, 25-26, 30, 32-33, 80-81, 85-86, 88-90 and 102-106 under 35 USC 103(a) as unpatentable over Buck et al. This rejection is respectfully traversed.

Claims 88 and 102

Claims 88 and 102 are not obvious over Buck et al. because Buck et al. does not teach a radiation source outside the chamber capable of providing radiation that is at least partially reflected from the substrate during processing and a radiation detector to detect the reflected radiation and generate an interferometric signal. Buck et al. provide no motivation or suggestion to have a radiation source outside the chamber and an interferometric detector to generate an interferometric signal. Buck et al. also does not teach a controller, as in claim 102, or a computer, as in claim 88, to "(i) receive the interferometric signal, (ii) calculate a dynamic variance within a predefined time period of the interferometric signal by subtracting an intensity value at a minimum point from an intensity value at a maximum point" as recited in the claims. Buck et al. uses a simple threshold comparison to evaluate a signal generated from plasma emission. Buck et al. provides no suggestion or motivation to evaluate the dynamic variance of an interferometric signal generated by detecting radiation originating from an external source and reflected from the substrate. Thus, Claim 88 and 102, and those claims dependent therefrom, are patentable over Buck et al.

**Rejection of Claims 1, 7-8, 13, 23-28, 30-37, 78-90 and 102-106 under 35 USC 103(a) as unpatentable ov r Angell et al. or Buck et al. in vi w of Brooks, Jr. et al., or visa versa**

The Examiner rejected claims 1, 7-8, 13, 23-28, 30-37, 78-79 and 102-106 under 35 USC 103(a) as unpatentable over Angell et al. or Buck et al. in view of Brooks, Jr. et al., or visa versa. This rejection is respectfully traversed.

Claim 1, 13, 78, 88 and 102

Claims 1, 13, 78, 88, and 102 are not obvious over Angell et al. or Buck et al. in view of Brooks et al. The non-obviousness of these claims over each of these references individually has already been discussed. Brooks, Jr. et al. does not make up for the deficiencies of Angell et al. or Buck et al. Angell et al. and Buck et al. have detectors that generate a signal from detecting a plasma emission, not an interferometric detector to generate an interferometric signal as recited in the claim. Brooks, Jr. has a detector to generate an interferometric signal, but does not have a controller or computer to calculate a dynamic variance as recited in the claims. Angell et al. has an apparatus that looks for an intensity drop-off over a certain period of time. However, there is no motivation to combine the evaluation peformed by the apparatus of Angell et al. to the type of signal generated by Brooks Jr. et al in any of these references. Interferometric signals are analyzed in prior art by counting the number of maxima or minima over a time period. There is no suggestion or motivation in any of these references to deviate from this practice to evaluate a dynamic variance as defined by the claims. Thus, Claims 1, 13, 78, 88 and 102, and those claims dependent therefrom, are patentable over Angell et al. or Buck et al. in view of Brooks Jr. et al.

Claims 8 and 83

Claims 8 and 83 are not obvious over Angell et al. or Buck et al. in view of Brooks et al. The non-obviousness of these claims over each of these references

individually has already been discussed. Brooks, Jr. et al. do s not make up for the deficiencies of Angell et al. or Buck et al. Angell et al. and Buck et al. generate a signal from detecting a plasma emission, not an interferometric signal as recited in the claim. Brooks, Jr. generates an interferometric signal, but does not calculate a dynamic variance as recited in the claims. Only Angell et al. calculates something resembling a dynamic variance. But there is no motivation to combine the evaluation of Angell et al. to the type of signal generated by Brooks Jr. et al in any of these references. Interferometric signals are analyzed in prior art by counting the number of maxima or minima over a time period. There is no suggestion or motivation in any of these references to deviate from this practice to evaluate a dynamic variance as defined by the claims. Thus, Claims 8 and 83, and those claims dependent therefrom, are patentable over Angell et al. or Buck et al. in view of Brooks Jr. et al.

Claims 23 and 36

Claims 23 and 36 are not obvious over Angell et al. or Buck et al. in view of Brooks et al. The non-obviousness of these claims over each of these references individually has already been discussed. Brooks, Jr. et al. does not make up for the deficiencies of Angell et al. or Buck et al. Both Angell et al. and Buck et al. have a detector to generate a plasma emission signal by detecting a plasma emission, not an interferometric detector to generate an interferometric signal. Brooks, Jr. has a detector to generate an interferometric signal, but there is no motivation to combine the detector to generate an interferometric signal of Brooks, Jr. with the detector to generate a plasma emission signal of Angell et al or Buck et al. Thus, Claims 23 and 36, and those claims dependent therefrom, are patentable over Angell et al. or Buck et al. in view of Brooks Jr. et al.

Claim 31

Claim 31 is not obvious over Angell et al. or Buck et al. in view of Brooks et al. The non-obviousness of this claim over each of these references individually has already been discussed. Brooks, Jr. et al. does not make up for the deficiencies of Angell et al. or Buck et al. Both Angell et al. and Buck et al. generate a plasma

mission signal by detecting a plasma mission, not an interferometric signal. Brooks, Jr. generates an interferometric signal, but there is no motivation to combine the interferometric signal of Brooks, Jr. with the plasma emission signal of Angell et al or Buck et al. Thus, Claim 31, and those claims dependent therefrom, are patentable over Angell et al. or Buck et al. in view of Brooks Jr. et al.

**Rejection of Claims 78-79, 82-84, and 87 under 35 USC 102(b) as anticipated by Kawahara et al.**

The Examiner rejected claims 78-79, 82-84, and 87 under 35 USC 102(b) as anticipated by Kawahara et al. This rejection is respectfully traversed.

Claim 78

Claim 78 is not anticipated by Kawahara et al. because Kawahara et al. does not teach "a controller to (i) receive the interferometric signal, (ii) calculate a dynamic variance within a predefined time period of the interferometric signal by subtracting an intensity value at a minimum point from an intensity value at a maximum point, and (iii) evaluate the dynamic variance of the interferometric signal in relation to a calculated or stored range of dynamic variances of the signal for a plurality of substrates to determine a property of the overlying or underlying material of the substrate" as recited in the claim. Instead, Kawahara et al. has an optical monitoring device to measure a time period for a predefined intensity change and uses this to calculate a deposition rate and expected deposition time. The optical monitoring device does not measure a dynamic variance but rather measures a time period. Thus, Claim 78 and the claims dependent therefrom, are not anticipated by Kawahara et al.

Claim 83

Claim 83 is not anticipated by Kawahara et al. because Kawahara et al does not teach"(c) calculating a dynamic variance within a predefined time period of the interferometric signal by subtracting an intensity value at a minimum point from an intensity value at a maximum point; and (d) evaluating the dynamic variance of the interferometric signal relative to a calculated or stored range of dynamic variances of

amplitude of the interferometric signal for a plurality of substrates to determine a property of the overlying or underlying material of the substrate" as recited in the claim. Instead, Kawahara measures a time period for a predefined intensity change and uses this to calculate a deposition rate and expected deposition time. This is different from calculating a difference in intensity and comparing this to a stored value. Thus, Claim 83, and those dependent therefrom, are not anticipated by Kawahara et al.

**Rejection of Claims 1, 8, 13, 23-24, 27-28, 31 and 34-35 under 35 USC 102(b) as anticipated by or, in the alternative, under 35 USC 103(a) as obvious over Kawahara et al.**

The Examiner rejected claims 1, 8, 13, 23-24, 27-28, 31 and 34-35 under 35 USC 102(b) as anticipated by or, in the alternative, under 35 USC 103(a) as obvious over Kawahara et al. This rejection is respectfully traversed.

Claim 1, 13

Claims 1 and 13 are not anticipated by Kawahara et al. because Kawahara et al. does not teach a controller, as in claim 1, or a computer, as in claim 13, to "(i) receive the interferometric signal, (ii) calculate a dynamic variance within a predefined time period of the interferometric signal by subtracting an intensity value at a minimum point from an intensity value at a maximum point, and (iii) determine a property of the overlying or underlying material on the substrate in the chamber based on the calculated dynamic variance of the interferometric signal" as recited in the claims. Instead, Kawahara teaches an optical monitoring device to measure a time period for a predefined intensity change and uses this to calculate a deposition rate and expected deposition time. This is different than a controller adapated to calculate a difference in intensity over a predefined time period, and use this to determine a property. Thus, Claims 1 and 13, and those dependent therefrom, are not anticipated by Kawahara et al.

Claims 1 and 13 are also not obvious over Kawahara et al. Kawahara has an optical monitoring device to measure a time period over a predefined intensity

difference to calculate a deposition rate. There is no motivation provided by Kawahara et al. to have a controller which calculates the change of intensity values. In fact, Kawahara predefines what change in intensity values are to be used by the optical monitoring device. Thus, the change in intensity is known beforehand and is just a constant value. Thus the predefined intensity in Kawahara is not a quantity that provides real information about the material on the substrate. Kawahara effectively teaches against a controller to measure a dynamic variance by predefining the intensity differences to be used. Thus, Claims 1 and 13, and those claims dependent therefrom, are patentable over Kawahara et al.

Claim 8

Claim 8 is not anticipated by Kawahara et al. because Kawahara et al. does not teach "(d) calculating a dynamic variance within a predefined time period of the interferometric signal by subtracting an intensity value at a minimum point from an intensity value at a maximum point; and (c) determining a property of the overlying or underlying material on the substrate in the process zone from the dynamic variance of the interferometric signal" as recited in the claim. Instead, Kawahara measures a time period for a predefined intensity change and uses this to calculate a deposition rate and expected deposition time. This is different than calculating a difference in intensity over a predefined time period, and using this to determine a property. Thus, Claim 8, and those dependent therefrom, are not anticipated by Kawahara et al.

Claim 8 is also not obvious over Kawahara et al. Kawahara is using the measured time over a predefined intensity difference to calculate a deposition rate. There is no motivation provided by Kawahara et al. to consider the change of intensity values as important. In fact, Kawahara predefines what change in intensity values are to be used. Thus, the change in intensity is known beforehand, i.e. mathematically it is just a constant in an equation, not a variable with a measured value. Thus the predefined intensity in Kawahara is not a quantity that provides real information about the material on the substrate. Kawahara effectively teaches against measuring a dynamic variance by predefining the intensity differences to be used. In contrast, it is the intensity difference, or the dynamic variance, which is used in Claim 8 to determine

a property. Thus, Claim 8, and those dependent therefrom, are patentable over Kawahara et al.

Claim 23

Claim 23 is not anticipated by Kawahara et al. because Kawahara et al. does not teach "a plasma emission radiation detector to detect a radiation emission originating from the plasma and generate a plasma emission signal over time, and a interferometric radiation detector to detect a radiation originating from the radiation source and reflected from the substrate and generate an interferometric signal over time; and a controller to receive the plasma emission and interferometric signals and to evaluate the two signals to determine a process endpoint" as recited in the claim. Instead, Kawahara teaches an optical monitoring device that only monitors a reflected radiation to generate a single signal. Thus, Claim 23, and those claims dependent therefrom, are not anticipated by Kawahara et al.

Claim 23 is also not obvious over Kawahara et al. Kawahara et al. does not suggest or provide motivation to have a plasma emission detector to generate a plasma emission signal from radiation emitted from a plasma. Kawahara et al. also does not suggest or provide motivation to have a controller which determines an endpoint from two different interferometric and plasma emission signals. It would not be obvious to have such a controller because the two signals that it is receiving contain fundamentally different types of information. Thus, Claim 23, and those claims depending therefrom, are patentable over Kawahara et al.

Claim 31

Claim 31 is not anticipated by Kawahara et al. because Kawahara et al. does not teach "detecting a radiation emission originating from the plasma and generating a plasma emission signal over time; (d) detecting a radiation reflected from the substrate and generating a interferometric signal over time; and (e) valuating the plasma emission and interferometric signals to determine the occurrence of an event in the process zon or a property of a material on th substrate" as recited in the claim. Instead, Kawahara et al. generates a single signal related to reflected light. This is

different than generating two signals, one r lated to reflected light and th other to plasma emission. Kawahara et al. also does not evaluate together a plasma emission signal and an interferometric signal to determine the occurrence of an event. Thus, Claim 31, and those claims dependent therefrom, are not anticipated by Kawahara et al.

Claim 31 is also not obvious over Kawahara et al. Kawahara et al. only detects radiation originating from an optical monitoring device and reflected from the substrate. Kawahara et al. does not suggest or provide motivation to use radiation emitted from a plasma. Kawahara et al. also does not suggest or provide motivation to evaluate an endpoint together from a plasma emission signal and an interferometric signal. Thus, Claim 31, and those depending therefrom, are patentable over Kawahara et al.

**Rejection of Claims 7, 25-26, 30, 32-33, 36-37, 80-81, 85-86, 88-90, 102-106, and 107-108 under 35 USC 103(a) as being unpatentable over Kawahara et al.**

Claim 36

Claim 36 is not obvious over Kawahara et al because Kawahara et al. does not teach "(c) a plasma emission radiation detector to detect a radiation emission originating from the plasma and generate a plasma emission signal over time, and a interferometric radiation detector to detect radiation originating from the radiation source and reflected from the substrate and generate an interferometric signal over time; and (d) a computer having a memory capable of operating a computer-readable program embodied on a computer-readable medium, the computer readable program including program code to receive the plasma emission and interferometric signals and determine an event in the chamber or a property of a material on the substrate" as recited in the claim. Kawahara et al. also does not suggest or provide motivation to have a detector to generate a plasma emission signal. Kawahara et al. also does not suggest or provide motivation to have a computer that determines an endpoint from two signals containing different kinds of information. Thus, Claim 36, and those claims depending therefrom, are patentable over Kawahara et al.

Claims 88 and 102

Claims 88 and 102 are not obvious over Kawahara et al. because Kawahara et al. does not teach having a computer, as in claim 88, or a controller, as in claim 102, to "(ii) calculate a dynamic variance within a predefined time period of the interferometric signal by subtracting an intensity value at a minimum point from an intensity value at a maximum point" as recited in the claims. Instead, Kawahara teaches an optical monitoring device to measure time over a predefined intensity difference to calculate a deposition rate. There is no motivation provided by Kawahara et al. to have a controller or computer to calculate the change of intensity values. In fact, Kawahara predefines what change in intensity values are to be used by the optical monitoring device. Thus, the change in intensity is just a constant value, not a quantity that provides real information about the material on the substrate. Kawahara effectively teaches against a controller or computer that measures a dynamic variance by predefining the intensity differences to be used. Thus, Claims 88 and 102, and those claims dependent therefrom, are patentable over Kawahara et al.

Claim 107

Claim 107 is not obvious over Kawahara et al. because Kawahara et al. does not teach "a controller to receive the signal trace and determine a property of the overlying or underlying material of the substrate in the chamber by determining whether the values of a sequence of slopes over time of the signal trace are substantially similar to the values of a sequence of preprogrammed slopes" as recited in the claim. Instead, Kawahara teaches an optical monitoring device to measure time over a predefined intensity difference to calculate a deposition rate. There is no motivation provided by Kawahara et al. to have a controller to calculate a series of slopes of an intensity signal and compare them to predefined values. Thus, Claim 107 is patentable over Kawahara et al.

Claim 108

Claim 108 is not obvious over Kawahara et al. because Kawahara et al. does not teach, inter alia, " valuating the detected radiation to determine a property of

the overlying or underlying material of the substrate in the process zone by determining whether a sequence of values of the slope over time of an amplitude of the detected radiation are substantially similar to the values of a sequence of preprogrammed slopes" as recited in the claim. Instead, Kawahara is measuring time over a predefined intensity difference to calculate a deposition rate. There is no motivation provided by Kawahara et al. to calculate a series of slopes of an intensity signal and compare them to predefined values. Thus, Claim 108 is patentable over Kawahara et al.

## CONCLUSION

For the foregoing reasons, allowance of the instant application is respectfully requested. Should the Examiner have any questions regarding the above amendments or remarks, the Examiner is requested to telephone Applicant's representative at the number listed below.

Respectfully submitted,

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